Subject: MS Colloquium-11/10/05-Zhukov 200, Auditorium
From: Nancy Sanchez <sanchez@anl.gov>
Date: Wed, 02 Nov 2005 09:08:33 -0600
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MATERIALS SCIENCE COLLOQUIUM

SPEAKER: Dr. Alexander Zhukov
University of Southampton
United Kingdom

TITLE: Self-assembly Routes towards Creating Superconducting and Magnetic Arrays

DATE: Thursday, November 10, 2005

TIME: 11:00 a.m.

PLACE: **Building 200, Auditorium**

HOST: Goran Karapetrov

Refreshments will be served at 10:45 a.m.

Abstract: Using self-assembly from colloidal suspensions of polystyrene latex spheres and various phases of lyotropic liquid crystals we prepared well-ordered templates. By electrochemical deposition of superconducting and magnetic metals in the pores of such templates highly ordered superconducting and magnetic anti-dot nano-structures were created with 3D architectures on length scales ranging from several nanometers to several micrometers. Further developments of this template preparation method allow us to obtain dot arrays and even more complicated structures. Superconducting Pb anti-dot arrays, prepared using latex sphere template, show pronounced Little-Parks oscillations in Tc and matching effects in magnetization and magnetic susceptibility. The spherical shape of the holes results in significantly reduced vortex pinning strength and introduces several new effects absent in standard lithographically prepared arrays. In magnetic anti-dot arrays we observe large increase in coercive field produced by nanoscale holes. We also find that the patterning transverse to the plane of the 3D nanostructured films governs the magnetic behaviour. In particular, the coercive field was found to demonstrate an scillatory dependence on film thickness. In magnetic dot arrays we have explored the genesis of 3D magnetic vortex and determined the critical dot size. Suppression of the shape induced magnetic anisotropy in our quasi-spherical dots is an important factor for the new behaviour of magnetic vortex. Our results demonstrate that self-assembly template methods are emerging as a viable, low cost route to prepare sub-micron
structures. The 3D architecture of these structures produces many unique properties absent in nanostructures prepared by conventional lithographical techniques.